A Keyboard For Me

A CISC 4900 Project by Richard Park

Trello: https://trello.com/w/cisc4900vc1brichardpark/home
Github: https://github.com/rsjpark/A_Keyboard_For_Me

Case Design

Original Plans

-   I had wanted to do a simple no frills case, that would be simple to print/manufacture and wouldn't take up a bulk of my time.
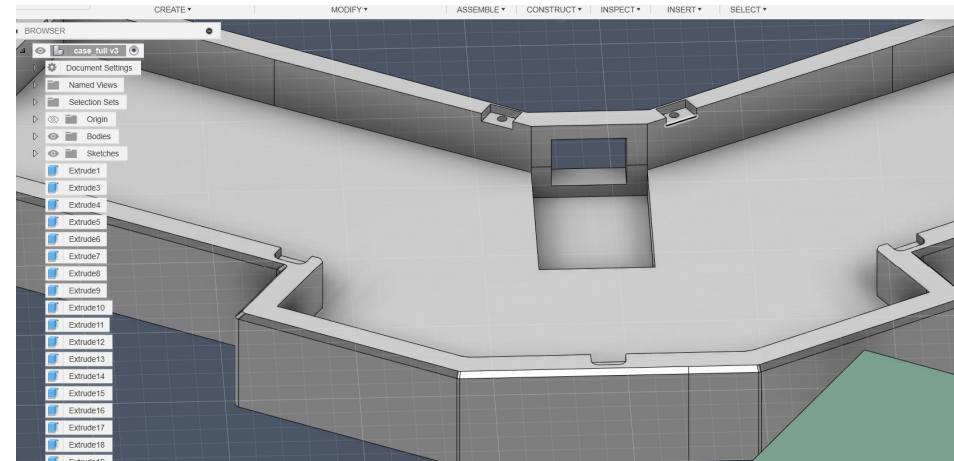
Demo 1 Timeline

-   Many of my hours were spent trying to get measurements for all of the aspects of the case, especially ones that I had not originally thought about.
-   At the moment I have 4 case designs that I'm slightly iterating on, with 2 of them being one that I feel will make the final cut.
-   I am still figuring out final decisions, as I hadn't thought of specifics like, where the mounting holes should be since this case won't be a single rectangle.
-   I am hoping for a minimal amount of mounting holes so I will continue to iterate

Case Design (cont.)

After Demo 1 Timeline

- After all of those designs, I had to scrap them due to pcb issues
- Having to accommodate the development board rather than just the mcu meant that I would have to change up dimensions
- There would need to be a thicker bottom for a taller cutout, and since dev board takes quite a bit of space, needed to make the gap between halves larger
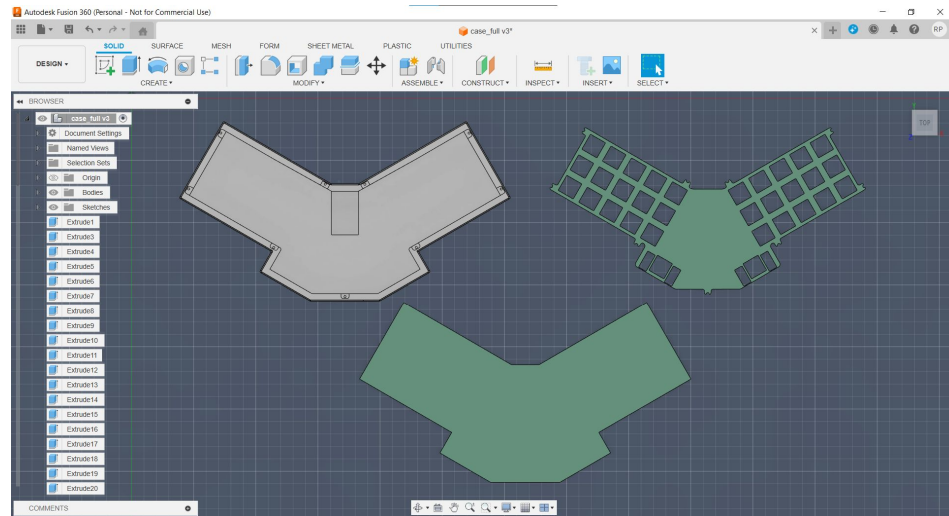
Case Design (cont.)

After Demo 1 Timeline

- I decided to wait until my pcb was finalized and until I could get all of the dimensions (pcb, plate, development board, pin headers)
- This step took quite a while

Case Design (cont.)

After Demo 1 Timeline

- The dimensions were given by creating an object in kicad that traced the dimensions of the plate and then imported as a step file into fusion
- After some hard fought tinkering the case came into its own

Case Manufacturing

Demo 1 Timeline

- Waiting on deciding an overall case design
- At the moment, version 3 is a front runner
- One issue with these cases are that their width being ~260mm makes it not fit on small to medium size printer beds.
- I have some recommendations for 3d printing services if the ones available near me are not of adequate size, as I'd rather not make a 2 piece case
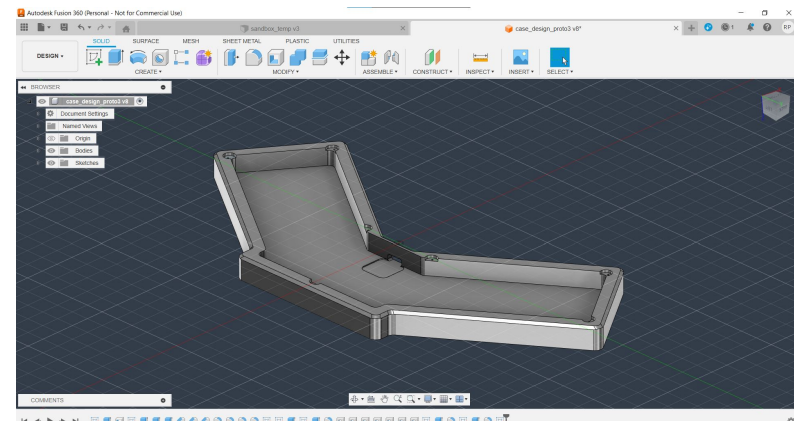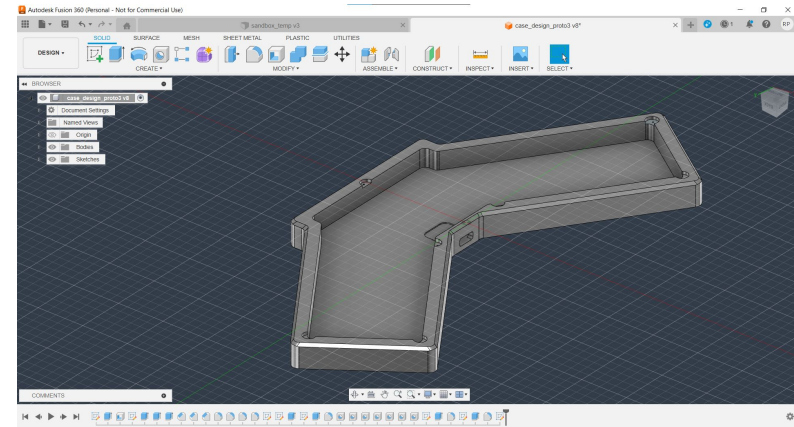
Case Manufacturing (cont.)

After Demo 1 Timeline

- I had originally planned to go to the Queens Library in Queensbridge to attempt to print the case, but was not able to due to availability.
- I chose to just make another order through jlc and sent in my files for printing
- Although I had created with tolerances in mind, the prints were very good, and made the 1mm edge tolerance I measured with look like the Grand Canyon when the plate was screwed in

Case Manufacturing (cont.)
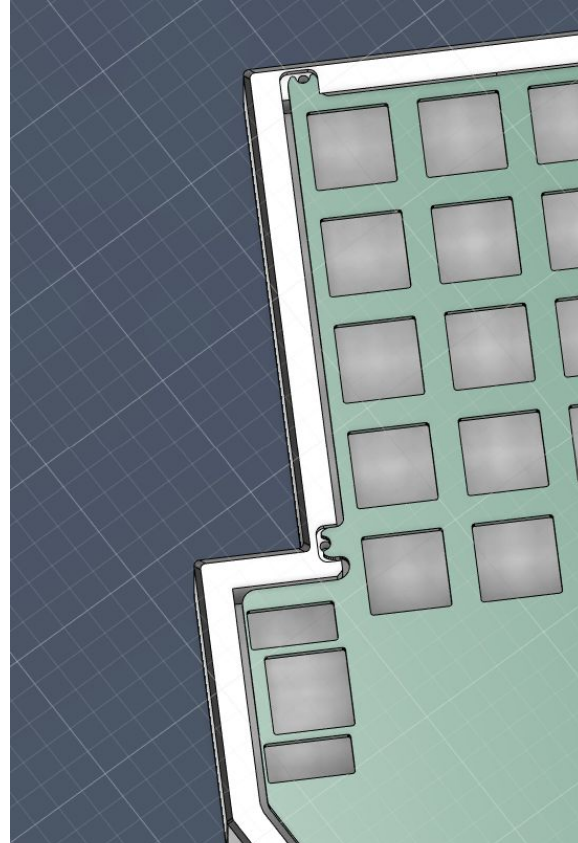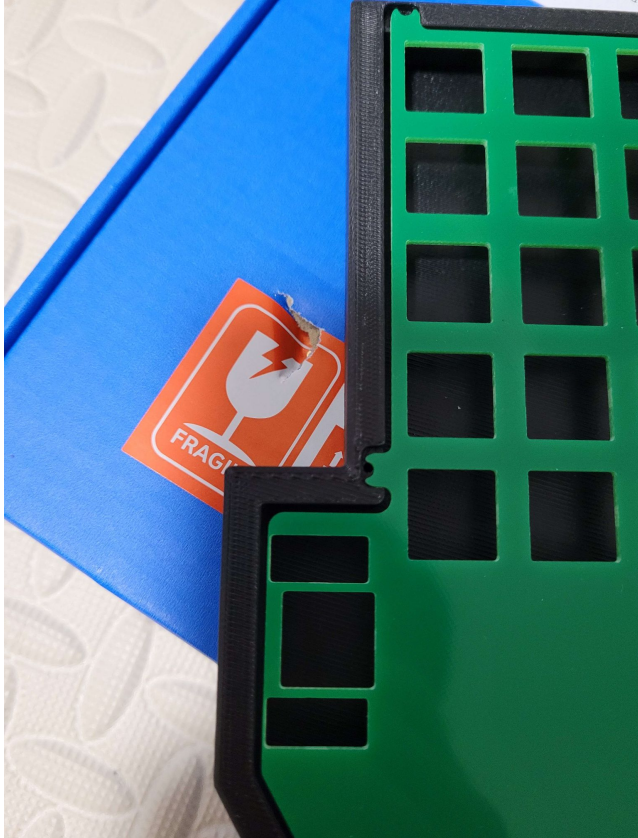
PCB Design

Original Plans

- Create an integrated pcb (simple as that)

Demo 1 Timeline

- As presented in the demo, I had finished up the pcb with rp2040/kb2040 devboard.
- As I wait on production, I am working on a whole new revision that is an integrated pcb

PCB Design (cont.)

After Demo 1 Timeline

- My original plan was to go and order the pcb I had by Demo 1 as the safety/working exercise pcb.
- ...I couldn't send it in for production. It was too messy
- I decided to just start working on the integrated pcb and have that ordered within a few weeks.
- It turned out to be too hard of a task. I was reading documentation on all of the extra parts needed that was already included in the development board.
- I was working on learning up on crystals/oscillators that were necessary due to the usb's strict protocols on timing, but realized I was running out of time.

PCB Design (cont.)

After Demo 1 Timeline

- I decided that with the new stuff that I learned along the way, I needed to get the kb2040 pcb redone and out for production.
- This still took around 2 weeks as I was still having troubles with routing and trying to troubleshoot the errors showing up in the drc
- Eventually with trial and error of redefining the pins on the dev board I was able to get it to a place where I could send it in for production

PCB Design (cont.)

VS
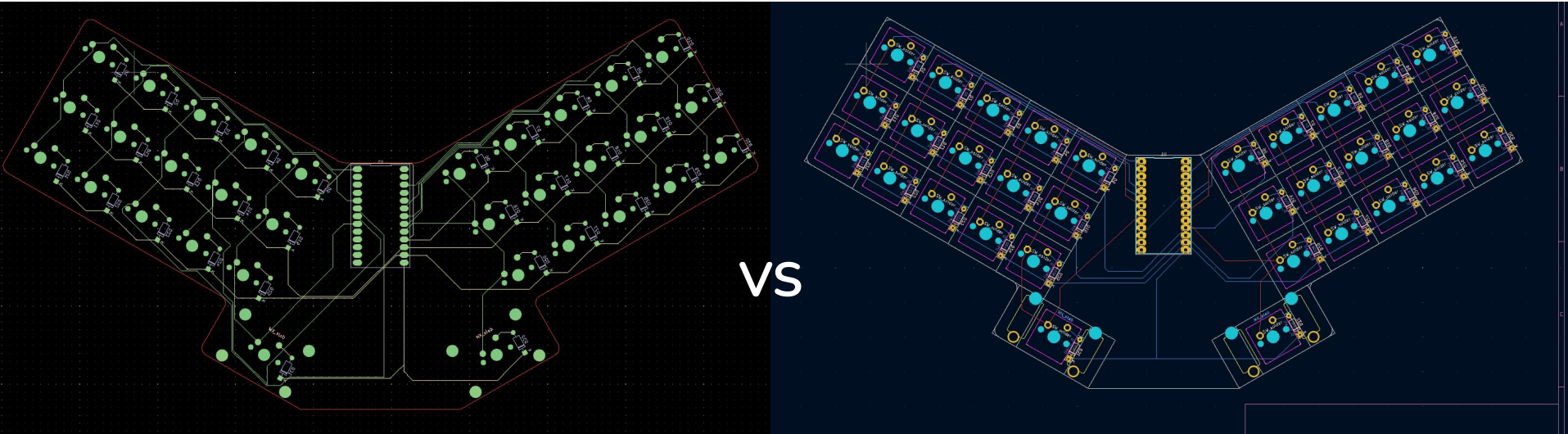
Original pcb that I nearly submitted before I cancelled the quote

Final pcb design that was sent for manufacturing
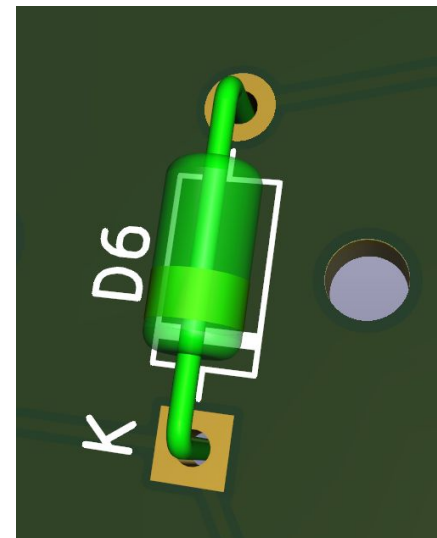
PCB Manufacturing

Demo 1 Timeline

- Currently I have the devkit version of the pcb going through a manual quote because the autoquoter was having issues. I hope to hear back from them in a few days.
- While that pcb is being quoted and sent for production, I will be continuing on working on the integrated pcb, making the devkit pcb a backup in case something goes wrong or I don't have enough time.
- Side note for the case, I saw that jlc has 3d printing and material milling services as well, so if all goes well and the price is reasonable I might check out their options.
- Milled polycarbonate or abs seems like a very interesting option

PCB Manufacturing (cont.)

After Demo 1 Timeline

- The ordering process came with its own hiccups.
- Many of the scripts that were used to create a BOM and the centroid files for jlc were not working and it took a bit of work to troubleshoot errors
- Those files were eventually created and sent for quoting, and in few days I received a notice from jlc that there was an issue with my order in which I had chosen parts (surface mount diode) that not work with the footprint that I had placed on my pcb (through holes for tht diodes)...

PCB Manufacturing (cont.)

After Demo 1 Timeline

- After some back and forth emails, I had decided that it would be easier to order and solder the diodes myself, rather than replace the footprints due to the rotation/positioning of my footprints
- They cancelled the assembly and proceeded with the order (which also had the plate in it)
- After receiving the parts in hand, everything looked great, which was a relief since their integrated gerber viewer was showing some wonky things

PCB Prototype

Order #: Y1-6990368A

Build Time: 24 hours

5 pcs $15.90

Product Details

GERBER-4900_keeb_for_me...

✓ Production Completed

Quality Complaint

Merchandise Total: $40.97

Shipping Charge: $55.93

Order Total: $96.90

Shipped

DHL Express Worldwide

🚚 Shipment Tracking

Reorder

Order Details

Invoice
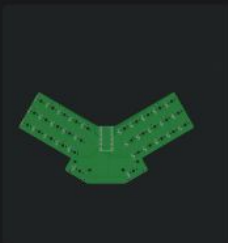
Economic PCBA

Order #: SMT023120515053...

Build Time: 1-2 days

2 pcs $10.36

Product Details

4900_keeb_for_me.csv

4900_keeb_for_me-bottom-p...

DFM Analysis

⊗ Audit Failed

cancel and refund as per email

PCB Prototype

Order #: Y2-6990368A

Build Time: 2 days

5 pcs $16.90

Product Details

GERBER-plate_pcb_Y2

✓ Production Completed

Quality Complaint

The gerber straight up just shows a green rectangle

Plate Design

Original Plans

- Create plates based off of pcb and case designs
- Create them while waiting for pcb manufacturing and case prototyping

Demo 1 Timeline

- Not much has changed
- Design follows the case design, so once the mounting worries are sorted out, should be easy enough to create a plate

Plate Design (cont.)

After Demo 1 Timeline

- The plate design portion was rather simple, and just took a few hours of playing around with the pcb kicad files and some lines/filleting
- I was able to use the dimensions of the plate to base my case dimensions off of as mentioned before

Plate Design (cont.)
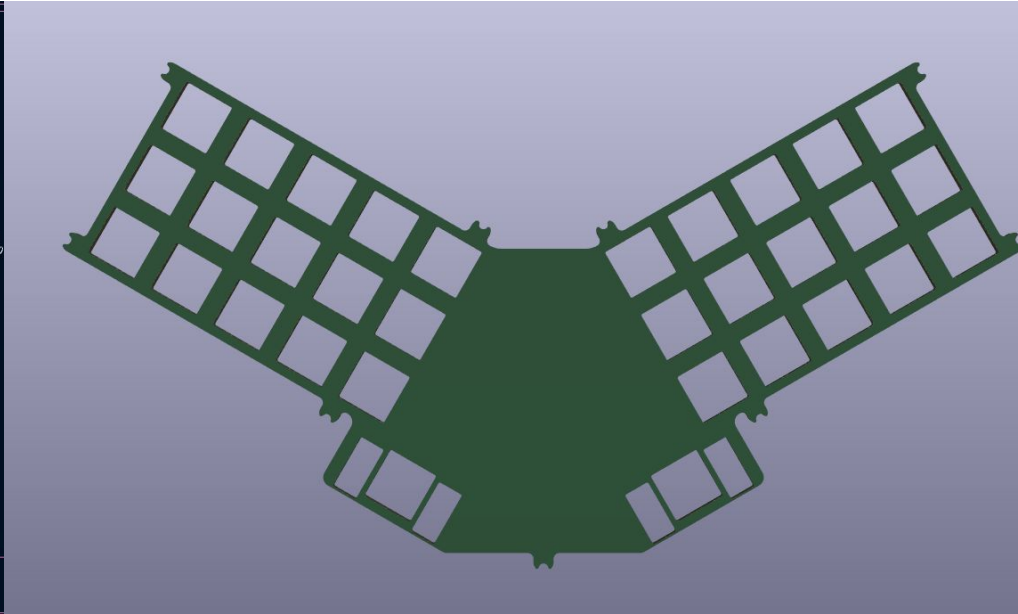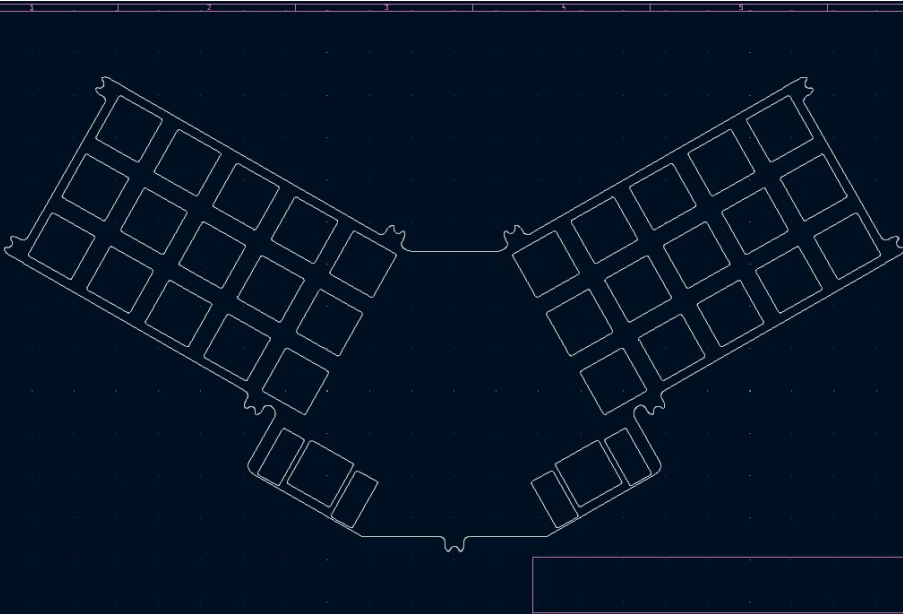
Plate Manufacturing

Demo 1 Timeline

- Waiting on final case design
- Still the same plans as talked about in the demo

Plate Manufacturing (cont.)

After Demo 1 Timeline

- Sent in files for manufacturing along with pcb
- Nothing went wrong in this department
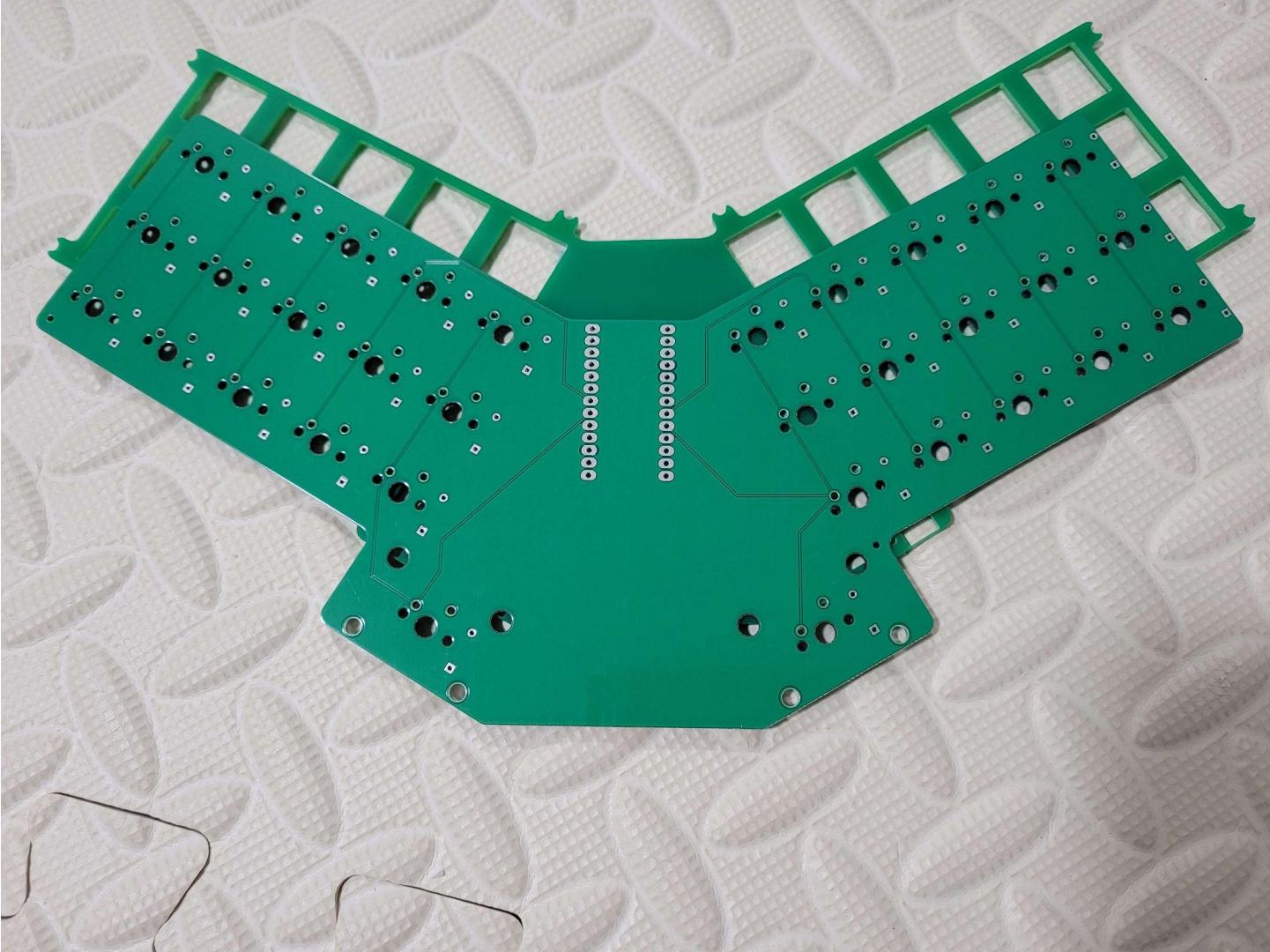
Layout Creation

Demo 1 Timeline

- Layout has been finalized
- Layers have been organized in google sheets so that it won't be a headache when creating a firmware for it

Firmware creation

Demo 1 Timeline

- Have not started working on firmware

Firmware creation (cont.)

After Demo 1 Timeline

- Firmware creation was pretty straightforward
- Reading the QMK documentation and looking at examples of other qmk keyboard firmwares made it pretty clear what I needed/wanted
- After I implemented my layout I had some errors in compiling my firmware with qmk msys and chalked it up to some mistakes and decided to chip at it over time.
- After some time I realized that nothing I was trying was working, and after some research and asking around I realized that in order to create your own keyboard/firmware and get it compiled in qmk you need to submit a pull request towards the main branch and get it accepted

Firmware creation (cont.)

After Demo 1 Timeline

- This was an issue as I thought that the firmware side of things was pretty much nearly done
- I did more digging and found 2 possible solutions.
  - Compile the firmware with the pico-sdk rather than qmk
  - Try out a hack where you use an already accepted keyboard's files and insert your own and try to compile it
- At this point I didn't have enough time to learn building firmware that wasn't from QMK, and my jlc orders were still not in hand
- I decided to go through the list of keyboards in the list until I found a keyboard that was similar to mine and decided insert my files and compile my firmware as if it was that keyboard
- I chose the reviung39 because it looked similar to my board, but it turned out that they were created very differently.
- There was quite a bit of troubleshooting that took a few weeks, but I eventually was able to compile my firmware and got the uf2 file that I needed to flash my rp2040/kb2040

Assembly

- This was when I started testing my board since I had put the firmware into the kb2040 already in advance.
- It was not pretty. The keytester was showing up random keys and mostly no keypresses.
- After some troubleshooting I decided to just solder in the switches and try to get a complete look of the build.
- The screws threaded themselves well and at least the physical build was complete. Although I am looking to sand the usb port down a few mm
- I took out the pcb from the case and have been troubleshooting since.
- I was able to get to this point where many of the keys are still not registering correctly.
- I am trying to work until the very end, but cannot determine where the issues lie. I'm wondering if it's a combination of both issues in the firmware and hardware/assembly.

File

| Esc | | F1 | F2 | F3 | F4 | | F5 | F6 | F7 | F8 | | F9 | F10 | F11 | F12 | | Print | Scroll | Pause | | Sleep | Mute | Vol - | Vol + |

| ~ ` | ! 1 | @ 2 | # 3 | $ 4 | % 5 | ^ 6 | & 7 | * 8 | (9 |) 0 | _ - | + = | Backspace | | Ins | Home | PgUp | | N.Lck | / | * | - |

| Tab | Q | W | E | R | T | Y | U | I | O | P | { [| }] | | \ | | Del | End | PgDn | | 7 | 8 | 9 | + |

| Caps Lock | A | S | D | F | G | H | J | K | L | : ; | " ' | Enter | | | | | | 4 | 5 | 6 |

| Left Shift | Z | X | C | V | B | N | M | < , | > . | ? / | Right Shift | | ↑ | | | 1 | 2 | 3 | N.Ent |

| Left Ctrl | LWin | LAlt | Space | RAlt | RWin | Menu | RCtl | | ← | ↓ | → | | 0 | . |

Reset Keyboard

Reset

Key sounds

Final Thoughts

- In the end I do not have a fully functional working product
- I feel like I'm very close and will continue working this out until I have a fully functional build,
- This project was a great experience in all of the issues that could arise when I create my next design.
- I think finishing this out will give me even better insight that I can carry along with me.
- Although this was very stressful (lol) I am very happy to have dove into the deep end to get me rolling on electrical components and 3d modeling.
- I retrospect, I think treating this project as both a learning/getting experience, as well as trying to fulfill a goal of satisfying my ergonomic needs was way too much.
- I believe starting out with a smaller perhaps 4-key test board, finalizing it, then moving onto a slightly more complicated, but still normal board would have really made things fall better into schedule.